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14. ABSTRACT The National Biocontainment Training Center (NBTC) provides standards-based theoretical and practical training to trainees and professionals preparing for work in biocontainment laboratories where especially dangerous pathogens will be handled. Training is staged and appropriately targeted to requirements for biological safety level 2 (BSL-2), BSL-3 and BSL-4. Structured coursework is designed to prepare trainees to safely manipulate pathogens, including growth, genetic and antigenic characterization, and molecular studies of pathogenesis. Coursework includes both theoretical training and supervised hands-on procedures tailored to meet the specific needs and requirements of the individual trainee.					
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INTRODUCTION

The **National Biocontainment Training Center (NBTC)** provides standards-based theoretical and practical training to students and professionals preparing for work in biocontainment laboratories where infectious agents, possibly including especially dangerous pathogens will be handled. Training is staged and appropriately targeted to requirements for biological safety level 2 (BSL2), BSL3 and BSL4. Structured coursework is designed to prepare trainees to safely manipulate pathogens, including growth, genetic and antigenic characterization, and molecular studies of pathogenesis. Coursework includes both theoretical training and supervised hands-on procedures tailored to meet the specific needs and requirements of the individual trainee. Advanced coursework includes hands-on mentored training in the containment laboratories, including consecutive training at BSL3 and BSL4 levels of containment should that be required by the researcher's needs. Specialized training in the handling of laboratory animals is also offered. Sponsored mentored training is available to scientists embarking on a career focused on high hazard pathogens at the BSL4 level through a dedicated fellowship. Fellows in this program work under the close supervision of an established mentor while addressing a research topic of their own choosing. Mentored scientists and fellows progress to full independent access to the BSL4 laboratory only when their mentor and laboratory director are fully confident of the individual's skills and abilities to work independently in this environment.

The NBTC also offers a unique training opportunity for facility operations specialists interested in pursuing a career as a biocontainment operations manager. To the best of our knowledge, this is the only such training program in the world. This program is designed as a series of modules which address specific aspects of the construction, maintenance and safe operation of a biocontainment laboratory. The coursework is tailored to the specific needs of the individual trainee and involves both didactic training and mentored hands-on work using the Galveston National Laboratory (GNL) as its classroom. Over the course of the training period, which is anticipated to require up to two years for completion, the fellow(s) will be directly involved in the maintenance of the laboratory, decontamination of specific laboratories, monitoring and replacement of filters, fans and control units, understanding the Building Automation System (BAS), and a wealth of other duties routinely seen in the operations of typical biocontainment facilities.

BODY

TATRC's financial support for the NBTC formally began on May 22, 2009 and this submission comprises our annual report for the period May 2012 to May 2013 for this initiative. The Laboratory Biosafety Training Center at The University of Texas Medical Branch was established and operational prior to receiving TATRC funding; consequently, the course structure and procedures were already in place and allowed the NBTC to implement enhanced training operations almost immediately. From inception to date, the NBTC has provided training to nearly 5,000 participants through the various courses offered. Below is a summary of the significant progress made over the preceding year (2012-2013) under TATRC support. Funding and accomplishments are organized by each specific aim as they were presented in our original proposal.

Staffing Report.

The NBTC relies on a cadre of highly skilled scientists, engineers and technicians to offer a robust portfolio of training opportunities to trainees and professionals working in the field of biocontainment. Below is a summary of the individuals supported in part by the TATRC award over the past reporting year and their roles in the operation and management of the NBTC.

Dr. Tom Ksiazek. Leadership of the overall NBTC program is provided by Dr. Tom Ksiazek, a veteran of nearly four decades of research and development addressing some of the most dangerous pathogens known to humankind, including the filoviruses, Ebola and Marburg, as well as other causes of viral hemorrhagic fevers such as Crimean-Congo hemorrhagic fever, yellow fever and dengue. Dr. Ksiazek also oversees the BSL4 mentored fellowship program and is responsible for the selection of fellows and for monitoring their progress. As the director of the GNL BSL4 laboratories, he has ultimate responsibility for the individuals working in this space and as such has final approval in determining when an individual has successfully mastered the essential skills needed to safely work independently in the BSL4 environment.

Dr. Anne-Sophie Brocard. Classroom and laboratory training is directed by Dr. Anne-Sophie Brocard, an accomplished virologist and experienced biosafety trainer who has directed the training center courses since their inception. Dr. Brocard provides both theoretical and practical training to trainees and monitors their progress as they develop appropriate skills for work at each level of biocontainment.

Ms. Je T'aime Newton. Dr. Brocard is ably assisted by Ms. Je T'aime Newton, a highly experienced instructor with extensive expertise in biocontainment. Ms. Newton provides specialized training at all levels of containment, but is specifically responsible for preparing trainees for BSL4 investigations, focusing her efforts on the proper care, use and maintenance of the protective "space suits" used in the BSL4 laboratory and other aspects of work in this highly specialized environment.

Ms. Vicki Jones. Ms. Jones is a critical member of the teaching staff who assists as a trainer in both the theoretical and practical training modules.

Ms. Belinda Rivera. Ms. Rivera is a critical member of the teaching staff who assists as a trainer in both the theoretical and practical animal training modules.

Mr. Jason Hardcastle. Mr. Hardcastle is a trainer and assists Ms. Jones and Rivera with the training of students, specializing in *in-vitro* techniques.

Ms. Dee Zimmerman. Ms. Zimmerman is the director of the University's biosafety program and offers guidance in the regulatory requirements for operation of any biocontainment facility.

Mr. Rodrigo Marques dos Santos. Dr. Santos works with ticks and tick borne pathogens, mainly tick-borne encephalitis virus. He will work with ticks and BSL4 agents within the maximum containment laboratories. He is currently undergoing mentored BSL4 training to gain independent access.

Ms. Sharon Walters. Ms. Walters serves as the business coordinator for the NBTC and is involved in the outreach program as well as registration process for all external trainees, nationally and internationally.

Dr. Janice Endsley. Dr. Endsley is an assistant professor on the UTMB faculty. She entered the BSL4 fellowship program in 2010. Dr. Endsley is an expert in tuberculosis and is preparing for work with XDR-TB. Dr. Endsley will continue in the fellowship for much of the current year as she gains critical experience and masters skills needed to work in this environment.

Dr. Dennis Bente. Dr. Bente is a BSL4 research scientist with the GNL at UTMB. He is an assistant professor in the Department of Microbiology & Immunology and he serves as a BSL4 scientific mentor for the NBTC. Dr. Bente's research concentrates on understanding how viruses cause disease with special focus on the pathogenesis of Crimean-Congo hemorrhagic fever virus and its transmission by tick vectors.

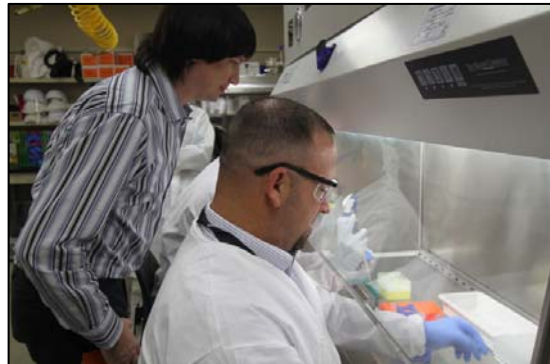
Dr. James LeDuc. Dr. LeDuc serves as the principal investigator for the NBTC award and is responsible for programmatic oversight, budgetary issues and reporting requirements. Dr. LeDuc has nearly four decades of experience in the conduct and supervision of research and development activities under biocontainment conditions and he has been intimately involved in the development of national policy in the fields of emerging infectious diseases, bioterrorism preparedness and biocontainment.

Teaching Laboratory Facilities.

The teaching laboratory is a critical asset of the NBTC and it is designed to offer trainees realistic exposure to the conditions and equipment they will typically encounter at each level of biocontainment as they conduct their studies.

At the **BSL2** level, this typically includes a biological safety cabinet where infectious pathogens are handled. *(pictured)*. Biological safety cabinets are used at all levels of biocontainment. The teaching laboratory also includes limited specialized equipment, as well as facilities to manage laboratory waste and storage of pathogens. Training for individuals preparing for work in the **BSL3** laboratory includes a dedicated area where individuals master the donning and doffing of protective gear and its proper disposal.

Those trainees going on to prepare for work in the **BSL4** laboratory have specialized instruction in the care and use of the positive pressure encapsulating ensemble or "space suit" that is worn in the most common type of **BSL4** laboratory in use today *(pictured)*. This includes inspection of the suit for any evidence of leaks prior to use, gaining experience and familiarity in the wearing of the suit, use of compressed air



hoses, and training in emergency procedures. In order to provide this training under realistic conditions, the training facility has been outfitted with a breathing air compressor and a mock laboratory where trainees can experience wearing the suit and become familiar with working in this unique environment. Some people discover that they experience claustrophobic reactions when wearing a suit; this practical, realistic suit training environment allows them to overcome any such reactions under well-controlled conditions, or decide that this work is not a good fit for them.

A key benefit of the support provided to the NBTC is the availability of resources that allowed for the renovation of our existing teaching laboratory facilities. We completely refurbished the training facility to significantly expand the mock laboratory space available to us, and to enhance the breathing air compressor and suit training area.

Laboratory training is conducted in the mock training laboratory with authentic laboratory equipment utilizing non-infectious materials. Entry into the lab is through a double door anteroom with directional airflow and mock pressure monitors. The laboratory has four class II biological safety cabinets, three of which are constructed with see-through panels which allow the trainer to introduce smoke into the BSC to visualize air movement within the BSC. One BSC



class II cabinet also has see-through panels and **BSL4** air connections ports. Two of the BSC cabinets are equipped with cameras inside that allow for remote demonstrations. The laboratory itself also has two cameras installed for remote demonstrations. The laboratory has two class III biosafety cabinets, incubators, centrifuges, bench top autoclave, refrigerator, -80° freezer, dunk tank, and general laboratory equipment to allow for mock BSL2 to BSL3 and -4 laboratory work. The laboratory is equipped with a compressor and air lines for practice in the suit check examination and use of BSL4 suits within that facility prior to the trainee entering the active BSL4 laboratories. The laboratory also has multiple airline drops allowing the trainee to work throughout the laboratory with the ability to connect and disconnect airlines as needed.

Overview of NBTC Training.

The NBTC provides a series of training modules involving a mixture of didactic instruction and hands-on training to be carried out within an existing mock BSL3/4 training laboratory that is located within the Environmental Health and Safety Office space in the Materials Management Building on the UTMB campus. The intent of the NBTC is to promote good laboratory techniques and safe procedures to be used at all biosafety levels, and to provide consistency in research practices. The program is designed to ensure that all training attendees have the same general biosafety training at BLS2 and -3, and if necessary BSL4, prior to entering an active biocontainment laboratory, thus ensuring that high safety standards are observed and good practice is consistently pursued.

BSL2 and BSL3 Training.

The BSL2 and -3 training provide a multi-phased approach:

- the assessment phase
- the training phase
 - theory
 - hands- on practicum
- final assessment



Each trainee begins with an **assessment phase** that includes a written test focusing on safety related topics, hands-on skills related to protocols based on their research using appropriate biosafety practices and procedures. During the assessment the trainer does not intervene as he/she notes both safety and scientific techniques employed by the trainee. This allows for the determination of experience and level of training that will be required for each trainee. Once the initial assessment is completed the results are reviewed with the trainee, the specific areas of training focus are identified. A written report is then sent to the trainee and their principal investigator or supervisor.

The **training phase** includes a theoretical class which covers the following topics:

- BSL1 through -4 standard microbiological practices, special practices, safety equipment and laboratory facilities.
- Personal protective equipment, types of respiratory protection, gloves, gowns, use and disposal.
- Proper use of laminar flow biological safety cabinets (BSC), how the cabinet functions, monitoring the BSC functions, setting up the work field, decontamination prior to and after work, and spill response in the BSC.
- Procedures with the potential for creating infectious aerosols, recognizing aerosol producing devices and learning how to mitigate and control aerosol production.
- Emergency procedures, spills in the laboratory, BSC, centrifuge, incident response, cleanup, first aid, reporting procedures, and medical emergencies in the lab.
- Waste management, types of disinfectants, types of waste generated, the differences in disinfection, decontamination and sterilization.
- Introduction to select agent rules and NIH-Office of Biotechnology Activities guidelines.

The hands-on practicum during the training phase compliments and reinforces the theoretical class and allows the trainee to experience different scenarios in a non-hazardous environment. It also allows the trainer to observe, advise and correct the trainee's techniques in the laboratory relative to safety as well as scientific issues (e.g. contamination of cultures). The practicum is specific to biosafety and agents to be used (e.g. bacteria, parasites, viruses) by the trainee. This approach also allows the use of specific protocols or facility specific practices that the trainee brings with them. Emergency response and spill mitigation training allows the trainee to visualize and respond to spills and contamination with the use of florescent dye and breakable training lab ware.

The **final assessment** is identical to the initial assessment, with a written exam and hands-on skills assessment. Once the trainee has completed and passed the final assessment, the trainee is provided with a certificate of training for the biosafety level they completed. A report is sent to the principal investigator, the trainee and the laboratory director.

Animal BSL2 (ABSL2) and Animal BSL3 (ABSL3) Training.

An animal biosafety training program was developed and instituted based on the same concepts as the BSL3 training program. Trainees must have completed BSL3 training before commencing ABSL3 training. All animal use is approved by our institutional animal care and use committee, and our animal holding facilities and procedures have been approved by AAALAC. All aspects of our ABSL2 and ABSL3 training program have been reviewed and approved by the USAMRMC Animal Care and Use Review Office (ACURO).

The ABSL training phase includes a theoretical class which covers the following topics:

- Personal protective equipment, types of respiratory protection, gloves, gowns, use and disposal.
- Proper use of the BSC, how the cabinet functions, monitoring the BSC functions, setting up the work field, decontamination prior to and after work and spill response in the BSC.
- Procedures with the potential to create infectious aerosols, recognizing an aerosol producing devices and learning procedures to mitigate and control aerosol production.
- Emergency procedures, spills in the laboratory or in the BSC, incident response, first aid, reporting procedures, and medical emergencies in the lab.
- Waste management, types of disinfectants, types of waste generated, the differences in disinfection, decontamination and sterilization.
- The hands-on practicum compliments and reinforces the theoretical class and allows the trainee to experience different scenarios in a safe working environment. It also allows the trainer to observe, advise and correct the trainee's techniques in the laboratory relative to safety as well as animal handling. The practicum is specific to biosafety and animal species to be handled. This approach to training also allows the use of specific protocols or facility specific practices the trainee brings with them.

In the third phase, the final assessment includes a written exam and a hands-on skills assessment. Once the trainee has completed and passed the final assessment the trainee is provided with a certificate of training for the biosafety level they completed.

BSL4 Training.

BSL4 training rests upon a firm adherence to the principles and specific practices of safe BSL-3 research. This practice prevents an over-reliance on the BSL4 suit as a primary means of personal protection, and makes the suit an operationally redundant means of personal protection, significantly enhancing overall containment. Accordingly, individuals who are selected for BSL4 training will have completed training at BSL3 and have been approved for independent access to the BSL3 laboratories. These individuals would then complete the BSL4 modular training.

Specific Aims.

Aim 1: To provide standards-based, high containment laboratory safety knowledge.

Standard training activities for UTMB staff, trainees and investigators from outside the University have been in place throughout the year. The number of individuals trained at each level is summarized in **Table 1** below and the associated figures. As summarized above, the topics typically covered in this introductory training include the principles of basic safety precautions in the laboratory, routine rules and regulations designed to protect the individual and environment from accidental contamination by an infectious microbe, and the care and use of the biological safety cabinet. Also covered are the appropriate procedures of clean-up following a spill, decontamination procedures, principles of the care and use of autoclaves and other essential equipment.

Aim 2: To provide standards-based, high containment laboratory hands-on training.

Training offered under this aim is directed at providing trainees with practical, real-world training in the laboratory setting. Course content is tailored to include those procedures and the use of specific equipment likely to be encountered by the trainee in their routine work. Thus, those destined to work in a virology laboratory may focus on those protocols most appropriate for use in a virology laboratory as opposed to those typically used when working with bacteria. There are, of course, common practices used in any BSL-2 laboratory and training on the safe conduct of these procedures is the foundation of this course. Training typically is undertaken in small groups of only one or two individuals, allowing for intense interaction between the instructor and trainees. By actually doing the procedures essential to their day-to-day laboratory work under the close supervision an instructor (with the use of indicator dyes that allow clear recognition of contamination), the trainee quickly grasps the key teaching points and rapidly masters safe laboratory practices. Training is offered in the state-of-the-art training laboratory described above.

The numbers of individuals trained under Aim 2 for the NBTC is summarized in **Table 1**.

Aim 3: To provide topic-specific training.

Autoclave Operations. A routine requirement for all persons working in containment laboratories is the need to be able to properly operate autoclaves. A dedicated training session is offered to all individuals as a separate element of their orientation to the GNL, and this training is offered to individuals working in other laboratories using the same or similar equipment.

Aerobiology. The GNL contains aerobiology laboratories at both the BSL3 and BSL4 levels of containment. The BSL3 facilities were fully commissioned and approved for use by the CDC and USDA in early 2010, and the GNL BSL4 facilities were approved for full operations in May 2010 with operations beginning in September 2010. These facilities are highly complex and require specialized



training not only in the operation of this sophisticated equipment, but also in the proper care and handling of the laboratory animals that will be experimentally infected.

Over the course of the past reporting year, aerobiology trainees have completed training on the BSL4 aerobiology equipment and have successfully performed BSL4 aerosol runs using Nipah virus and Ebola virus in the GNL. Training has also taken place on the EMKA plethysmography equipment. Aerobiology personnel continue to receive instruction and specialized training about how aerosols are generated, the safety precautions in place in aerobiology laboratories and how to quantitate virus in aerosol samples.

Gamma Irradiator Training. BSL4 laboratories utilize a number of techniques to inactivate biological materials prior to removal from the containment laboratory. One of the most frequently utilized means of removing materials from the BSL4 laboratory is inactivation by gamma irradiation. In an effort to provide training of individuals that use gamma irradiation at UTMB, a module providing background on radiation biology, radiological and biological safety training, select agent and radiological security training, introductory training on dosage determination and method validation, and practical instruction on the use of the devices used for gamma bombardment was assembled and is offered to staff on an as needed basis.

High Through-Put Screening. We are working to develop a systematic training program focused on the safety concerns associated with high through-put screening. We will continue to develop this capability in future years as it represents the cutting-edge interface between technology and biological sciences and as such potentially creates new challenges for biological safety.

Aim 4: To provide a mentorship program for scientists working in BSL3/ABLS3 or BSL4/ABSL4 facilities.

Mentored training typically extends beyond a given reporting quarter. The BSL4 mentorship program provides a hands-on training experience under the tutelage of a senior staff scientist (mentor) with guidance from other experienced laboratorians in the real-world environment of a functioning BSL4 laboratory. The experience includes an orientation to the laboratory environment by a senior BSL4 scientist and then working experience with tasks germane to the proposed tasking of the person being mentored.

As the GNL laboratory was brought online and the Shope laboratory continues to operate, our cadre of experienced BSL4 scientists and scientific staff continues to expand (Figures 1 & 2). This is actually decreasing the individual burden of training as it is now spread across a larger number of scientists and staff. The numbers of staff that have passed into and out of the mentorship program is presented in **Table 1**.

An extensive listing of the number of individuals trained during the reporting year can be found in **Table 1**.

Figure 1. Cumulative Number of Independent BSL4 Users – January 2005-January 2013

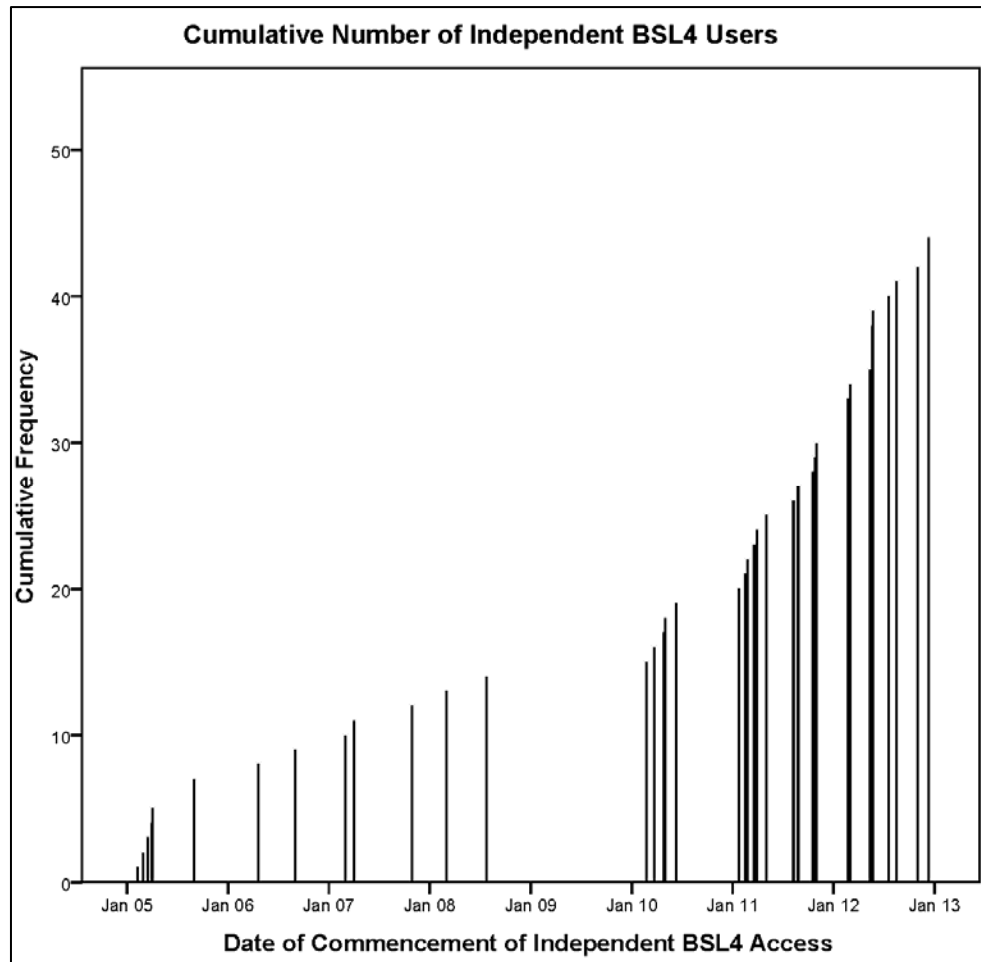
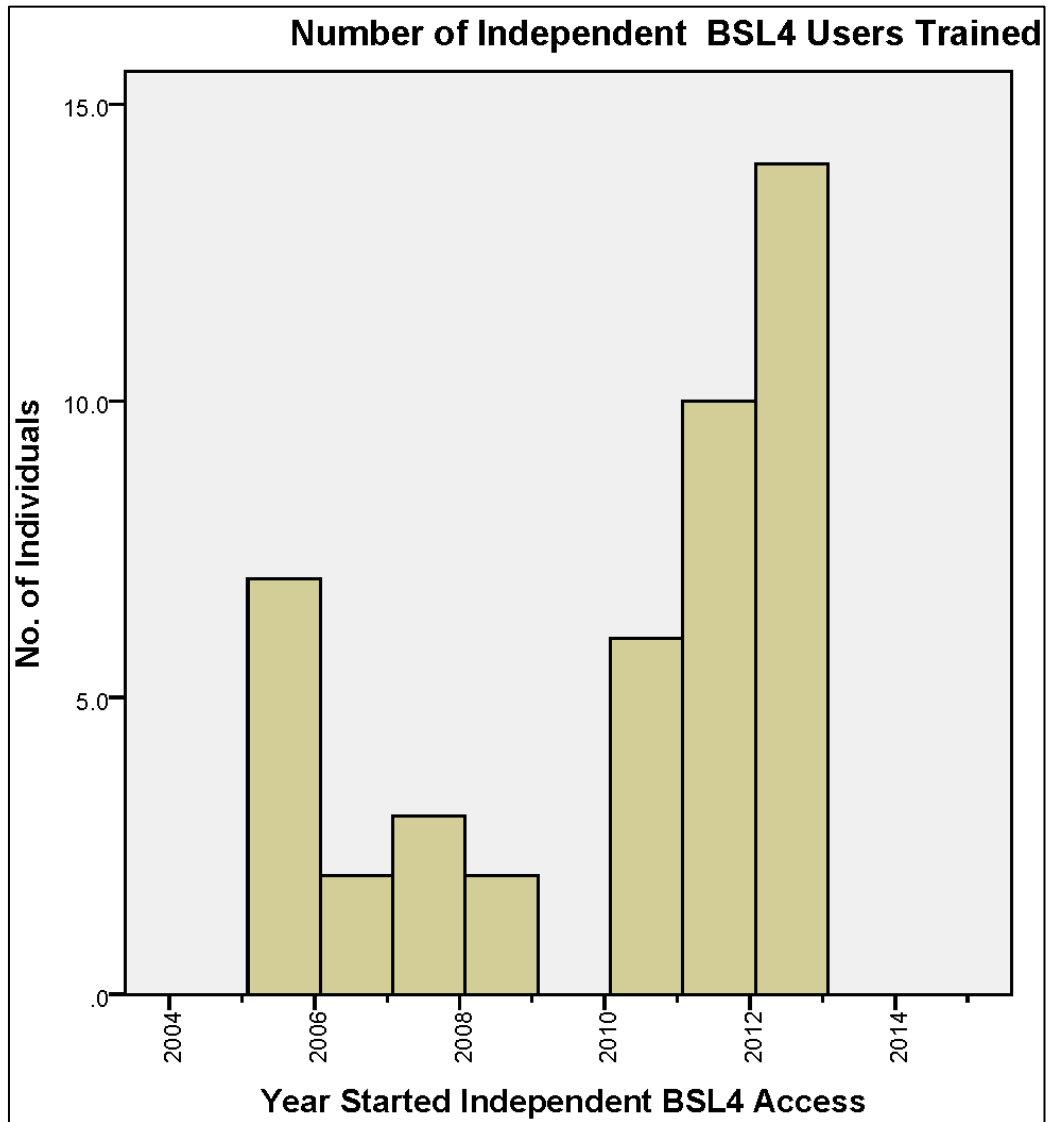


Figure 2. Number of Independent BSL4 Users Trained – 2004-2013



Aim 5: To establish a fellowship program for scientists and facility operations professionals working in BSL3/ABSL3 or BSL4/ABSL4 facilities.

The high and maximum containment fellowship program for scientists is in place. We have two fellows now in training, and one fellow who has transitioned from the program to a permanent UTMB faculty position involving BSL4 pathogen research.

Dr. Gavin Bowick is the first NBTC fellow who had transitioned from the NBTC fellowship to a permanent UTMB faculty position. Unfortunately, Dr. Bowick left UTMB following his training. Dr. Janice Endsley is the second fellow sponsored by the program. As indicated previously, Dr. Endsley is an expert in tuberculosis and is preparing for work with XDR-TB. We anticipate that Dr. Endsley will continue in the fellowship as she gains critical experience and masters skills needed to work in this environment.

Dr. Endsley's updates from quarterly reports over the past year detail her progress:

August 2012 Report: Dr. Janice Endsley is a fellow in training in the high and maximum containment fellowship program for scientists. To date she has gained two years of BSL3 laboratory experience performing independent in vitro and animal research in BSL3. In the ABLS3, she has optimized in vivo imaging using the Caliper Life Sciences IVIS system (equipment scheduled for use in the ABSL4 facilities) to track infection in the lung over the time course of disease in a mouse model. She has completed theoretical training for BSL4 work, successfully passed the BSL4 health screening process, and completed BSL4 facilities and suit training. Her mentored training in the BSL4 is continuing under the guidance of Dr. Alex Freiberg. During the mentored training component she will be contributing immunological expertise towards investigations by Dr. Freiberg and Dr. Nadya Yun specific to innate immunity and vaccine development for Rift Valley fever virus and Lassa virus (LV).

October 2012 Report: She has completed all the training and health screening to move forward with lab BSL4 training. Her mentored training in the BSL4 is under the guidance of Dr. Alex Freiberg and she further contributes immunology expertise for Dr. Slobodan Paessler's BSL4 virus (Junin) work at UTMB. This year she is additionally providing hands on training for Environmental Health and Safety specialist Vickie Jones specific to work with *Mycobacterium tuberculosis* (*M.tb*). This training allows Ms. Jones to make biosafety recommendations and provide pathogen-specific training for laboratory personnel that will be working with *M.tb*. She additionally consults with the faculty at the Universidad de Monterrey in Monterrey, MX regarding SOP for working with *M.tb* and handling of MDR-TB isolates that will be shared with UTMB and other U.S. investigators through collaborative arrangements.

January 2013 Report: Dr. Janice Endsley has been the principle investigator for the tuberculosis laboratory in the GNL since 2010 and supervises a research team working with TB in the BSL3 and ABSL3. Her research with *M.tb* is focused on discovery of mechanisms of protective immunity to *M.tb* and gaining an understanding of the microbial synergy between *M.tb* and HIV. Additionally she has developed standard operating procedures (SOP) for measuring immune status parameters in high containment, including T cell memory recall and inflammatory cell (e.g. neutrophils, monocytes) recruitment to sites of infection using animal models of *M.tb*, *Burkholderia mallei*, and *B. pseudomallei*. These procedures include application of magnetic bead-based cell sorting, fluorescent microscopy, and multivariate (11 color) flow cytometry

within high containment. Her lab has recently been approved for work with MDR-TB and the use of an *in vitro* assay that employs human macrophages to screen activity of novel anti-mycobacterial drug compounds. Currently she is providing mentored training to two new scientists for work with *M.tb* in the BSL3 and ABSL3, bringing the total number of scientist trained for work in the TB laboratory to six. Specific to BSL4, this year she has been collaborating with Dr. Slobodan Paessler on a Junin virus project that is focused on investigation of the anti-viral immune response of human dendritic cells to bridge innate and adaptive immunity.

Current quarterly report (through March 2013): Dr. Janice Endsley continues to build and maintains a collection of *M.tb* reference isolates and clinical isolates obtained from patients with drug resistant and drug susceptible TB. This past year she provided mentored training for UTMB EH&S personnel for work with *M.tb*. This allows the EH&S staff to develop TB protocols and training programs as part of their educational mission through the Laboratory Bio-containment Training Program including training workshops held in South America and Africa, where TB is a high priority area for labs beginning to work in BSL3 environments. In addition she has provided TB lab training for a senior GNL laboratory scientist, three research associates, and two graduate students. She also mentored a graduate student and a postdoctoral fellow for BSL3 work with *Burkholderia pseudomallei*. Dr. Endsley has developed several animal models in ABSL3 including a humanized mouse model of TB, a TB/HIV co-infection model, and is currently working to develop an latent TB model. She additionally works in collaboration with Dr. Alfredo Torres to develop mouse models of aerosol-acquired Melioidosis due to *Burkholderia pseudomallei* (Tier 1 select agent) infection. She has developed, optimized, and/or adapted several new techniques for study of *M.tb* or *B. pseudomallei* in the BSL3/ABSL3 including confocal microscopy-based bacterial viability detection, in vivo imaging of bacterial infection in live animals., multi-color flow cytometry, multi-plex ELISA, and in vitro HIV/TB co-infection assays. Her lab is now approved for work with MDR-TB and the use of an in vitro assay that employs human macrophages to screen activity of novel anti-mycobacterial drug compounds.

Dr. Aysen Gargili is the program's third fellow. Dr. Gargili a veterinarian and internationally recognized tick expert from Turkey who is also participating in the maximum containment fellowship program for scientists. She has spent a year onsite at UTMB and has recently gained full independent access to our BSL4 laboratories. (She began her fellowship in January 2012 and will be departing in summer 2013).

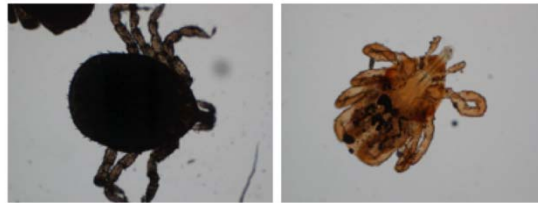
Dr. Gargili's updates from quarterly reports over the past year detail her progress:

August 2012 Report: Dr. Gargili has been working with Dr. Dennis Bente and a team of researchers to establish colonies of vector ticks from Turkey and elsewhere and will be studying how the virus is maintained and transmitted in nature. This is the first step in what we hope will grow into sustained field and laboratory collaborations with Turkish students and scientists. Dr. Gargili has also been studying the various methods and mechanics of biocontainment as a part of her fellowship.

October 2012 Report: Dr. Aysen Gargili, also a fellow in training in the high and maximum containment fellowship program for scientists, completed mentored training this quarter as well as individual hours in BSL3 and is now certified to work individually in BSL3. Dr. Gargili also completed her checklist training, suit tests and started to her mentored hours in the BSL4. Thus far she has made ten entrances and amassed thirty hours of mentored hours in the BSL4. She

has added more vector tick species to our colonies and has been successful in establishing a self-sustaining colony establishment. She has also developed and improved the infestation techniques that her team will use for animal infestations in BSL4. They presented some of these data in FP-7Arbozoonet's final meeting poster presentation. She and her team have also collaborated with researchers working on real-time live imaging, and currently are working on the development of imaging techniques in live ticks/animals which will be employed in BSL4 for the visualization of the virus in the vector and the host. Dr. Gargili's plan for the next quarter is to complete her mentored entrances and hours in the BSL4 and begin planned studies.

January 2013 Report: During this reporting quarter Dr. Gargili has made 33 entrances and amassed 80 hours in the BSL4 laboratory as a part of her training toward full, independent access to the laboratory. She has started infectious disease studies and has undertaken



the establishment of an infected tick colony in BSL4. She and her research team have also made progress on further infectious studies for the visualization of virus either in the tick or in infected animals with real-time imaging techniques. They have accumulated critical data on the imaging techniques in live ticks/animals and started to use this data in BSL4 for the visualization of the virus in the vector and the host. Collaborations with Dr. Gustavo Valbuena – a GNL researcher – and his team have begun with humanized mice and infected ticks in BSL4 to see the preliminary results of the infection on human skin.

Current quarterly report (through March 2013): Upon her return to Turkey later this year, Dr. Gargili will direct a national biocontainment facility outside Istanbul. During this reporting quarter we are enthusiastic that Dr. Gargili accumulated necessary entries and hours in the BSL4 and qualified for independent access. She and her team of researchers began infectious studies with the establishment of an infected tick colony in BSL4. To our knowledge, this is the only such work being conducted at BSL4 in the country and potentially the world. Dr. Gargili and her colleagues also designed further infectious studies for the visualization of the virus either in the tick or in infected animals with real-time imaging techniques. They accumulated critical data on the imaging techniques in live ticks/animals and started to use them in BSL4 for the visualization of the virus in the vector and the host. Her team also continued to collaborate with UTMB researcher Dr. Gustavo Valbuena's team and began to infest humanized mice with infected ticks in BSL4 to see the preliminary results of the infection on human skin. We are proud to have the opportunity to mentor the next generation of scientists that will undertake this groundbreaking research.

The laboratory containment operations fellowship is unique and is, to the best of our knowledge the only one of its kind. The program promises to set a new standard for preparation of individuals working in this highly specialized environment. Unlike the fellowship for scientists, where the candidate is likely to already have solid technical skills and will be applying them in the containment environment, most entering facility operators will require a more structured course of study. Consequently, we have identified fourteen distinct modules to be covered over the course of the fellowship. These structured modules cover basic microbiology, provide an overview of biosafety and biocontainment principles, construction methodologies specific for each level of containment, risk assessments, select agent regulations, formal Good Laboratory Practices, annual certification of laboratories, testing of HEPA filter

housing and filters, air balancing procedures, building automated systems and engineering controls, effluent treatment systems, autoclaves care and use, decontamination procedures, biosafety cabinet certification, and laboratory operations SOP development and record keeping.

During the course of their training, fellows will directly participate in each of these activities, as well as be personally involved in the planned shut down and decontamination of containment suites, validate decontamination, and conduct and oversee maintenance activities. Plans are being developed to allow fellows to visit other high and maximum containment laboratories across the nation during the second year of their fellowship to better understand the diversity of facilities and variations in containment practices.

Aim 6: To provide training in Biosurety and Biosecurity for both leaders of biocontainment laboratories and for staff working in such facilities.

Over this past year of support we have actively participated in the national dialogue over the critical elements necessary for an effective program in biosurety and biosecurity of biocontainment laboratories. This remains an evolving field, with guidelines still being developed and a legal foundation yet to be established. As these issues are being debated nationally, we have continued to provide our expert opinion through the American Society of Microbiology and other organizations at the fore of these discussions. We have also participated in ongoing discussions on these topics hosted by the National Science Advisory Board for Biosecurity (NSABB) and the Trans-Federal Task Force on Optimizing Biosafety and Biocontainment Oversight.

Biosurety and biosecurity are currently covered in our theoretical training sessions, and we are in the process of developing a structured course to more specifically address biosurety and biosecurity in depth. We anticipate posting this course on our internal website as an educational tool to augment our more formal training opportunities and to complement lectures already offered. Depending upon the success of this internal posting, we will then consider posting the course on our website where it would be available to the general public.

As part of our participation in the national dialogue on biosecurity – and as a service to the research community – we also established a distinguished speaker series. Our *Topics in Biosecurity Symposia Series* has been offered since 2010. Sessions in the series continue to be of great interest to students, faculty and community members and are consistently attended by large crowds drawing positive attention and feedback.

Summary of Biosurety and Biosecurity training activities this past year:

Topics in Biosecurity Symposia Series.

- **October 4, 2012 – Dr. Jeanne Guillemin.** Dr. Guillemin (pictured right with Dr. James W. Le Duc) was the guest speaker for the eighth session in this distinguished speaker series. She was a guest of the NBTC on Thursday, October 4, 2012. She delivered a seminar



entitled *The 2001 Anthrax Letter Attacks: Bioterrorism and the American Response*. Dr. Guillemin is a senior fellow with the Massachusetts Institute of Technology's Center for International Studies. She is also an acclaimed author of *Anthrax* (1999), *Biological Weapons* (2005) and *American Anthrax* (2012).



Dr. Guillemin delivered her seminar to a capacity crowd of students, staff and local community members to great reviews. She also spent time with our aerobiology service division students and staff (*pictured right*) discussing the intricate aspects of her research.

- **December 7, 2012 – Dr. Philip K. Russell (US Army MG, ret.) and Dr. Gigi Kwik Gronvall** (*pictured right*) jointly presented the session “Biological Weapons: Does U.S. biodefense meet the threat?” Dr. Russell is a former senior advisor to the Assistant Secretary for Public Health and Emergency Preparedness, U.S. Department of Health and Human Services – and the former Commanding General of the U.S.



Army Medical Research and Materiel Command. Dr. Gronvall is a senior associate at the University of Pittsburgh Medical Center's Center for Biosecurity.

- **January 7, 2013** – The NBTC was proud to host **Dr. James P. Burans** and his team (*pictured right*) from the National Biodefense Analysis and Countermeasures Center's (NBACC) genomics program. Dr. Burans, along with **Dr. Nicholas Bergman**, **Dr. Adam Phillipy** and **Dr. M.J. Rosovitz** presented a program of the work underway at NBACC and the use of advanced genomics in their research entitled “*The National Bioforensic Analysis Center and the Use of Genomics in Bioforensic Analysis.*”



- **February 12, 2013 – Dr. Malcolm Dando** was the featured guest for this eleventh session in the speaker series. Dr. Dando (*pictured right*) is a professor of international security at the University of Bradford in the United Kingdom. A biologist by training, his main research interest is in the preservation of the prohibitions embodied in the Chemical and the Biological Weapons Conventions at a time of rapid scientific and technological change in the life sciences. His presentation topic was entitled, *“Biosecurity Education for Practicing Life Scientists: The Missing Past, Unsatisfactory Present and Uncertain Future.”*



- **April 18, 2013 – Dr. Patricia Nuttall** was the honored guest for the most recent session in the speaker series. Dr. Nuttall (*pictured right alongside UTMB faculty and NBTC scientists Drs. Dennis Bente, Aysen Gargili and Jim LeDuc*) is a professor of arbovirology in the Zoology Department at Oxford University in the United Kingdom. Dr. Nuttall is formerly with the Natural Environment Research Council where she served as director of the Centre for Ecology & Hydrology. Her research interests focus on viruses transmitted by ticks and how tick saliva promoted virus transmission. Her presentation was entitled, *“The Role of the Health Protection Agency in Homeland Defense for the United Kingdom.”*



Each of these sessions was widely attended by UTMB faculty, staff, students and Galveston community members. This popular speaker series will continue through 2013 with several sessions already in the planning stages.

NBTC Website.

Over the past reporting year, the new NBTC website has continued to develop - www.utmb.edu/nbtc and it has become a home base for the program. Course training schedules and staff listings are continuously added to the website. We also updated our staff listing with new members of the training team. Per its intent, this site serves as a hub of information regarding the Center, our goals, and the resources that the NBTC makes available to the biosafety and research communities.



Onsite/Offsite training and related updates from the past reporting year.

- **NBTC Informational Booth.** The NBTC informational booth was present at an impressive number of professional meetings during this reporting year. In each location, NBTC trainers detail the program for prospective participants and are on hand to answer specific questions from interested individuals. :
 - The American Society for Microbiology Biodefense Meeting, February 26-29, 2012 in Washington, DC
 - The American Society for Microbiology 112th General Meeting, June 16-19, 2012 in San Francisco, CA
 - The African Biological Safety Association Conference, June 24-27, 2012 in Johannesburg, South Africa
 - The American Society of Virology Annual Meeting, July 21-25, 2012 in Madison, WI
 - The 55th Annual American Biological Safety Association Conference/Meeting, October 18-24, 2012 in Orlando, FL
 - 63rd American Association for Laboratory Animal Science National Meeting, November 4-8, 2012 in Minneapolis, MN
 - The American Society of Tropical Medicine and Hygiene Annual Meeting/Conference, November 11-15, 2012 in Atlanta, GA
 - USDA/ARS/ABSA, February 4-7, 2013 in Alexandria, VA
 - The American Society for Microbiology Biodefense Meeting, February 25-27, 2013 in Washington, DC
- **Biocontainment engineering.**
 - Throughout the past reporting year, resident biocontainment engineer Mr. Miguel Grimaldo, actively participated as a member of the ANSI Z9.14 Committee to development of an **American National Standards Institute (ANSI)** standard for "Testing and Performance Verification Methodologies for Ventilation Systems for Biological Safety Level 3 (BSL3) and Animal Biological Safety Level 3 (ABSL3) Facilities." This work has included the writing and/or revision of sections of the standards and participations in conference calls. The third draft of the standard was presented to the full committee on March 31, 2013 and it is currently going through the final comments and edits. It is expected that the standard should be ready for public review by the fall of 2013.
 - From June 2012 to May 2013, Mr. Grimaldo responded to requests for information/guidance on biocontainment related issues from the following:
 - **NIH Integrated Research Facility** in Ft. Detrick, MD regarding autoclave cycles and APR door operations for BSL4 Laboratories.
 - **University of Monterey, Mexico** regarding BSL3 Facility Commissioning and Testing.
 - **Centers for Disease Control and Prevention's Office of Health and Safety** regarding the decontamination and certification of Membrane (PTFE) filters used on vent lines of BSL4 and BSL3 Enhance Laboratories.
 - **National Institute for Human Viral Diseases "Dr. Julio I. Maiztegui". Pergamino, Argentina** regarding BSL3 Commissioning and Operations.
 - **University of Hawaii** on BSL3 facility re-verification.

- **Victorian Infectious Disease Reference Laboratory, Melbourne, Australia** regarding BSL4 operations.
- **National Institute of Health, Office of Research Facilities** on BSL4 Facility Operations.
- **Public Health Agency of Canada. Biocontainment Engineering and Facility Operations. Pathogen Regulation Directorate** on BSL4 breathing air suit airflow setup and verification.
- **Centers for Disease Control and Prevention (CDC)**, BSL4 Facility Training of a select Agent Inspector.
- **U.S. Army Corps of Engineers, Fort Detrick Integrated Program Office** on Certification of membrane (PTFE) filters used on Effluent Decontamination Systems.
- **Boston University, National Emerging Infectious Diseases Laboratories** regarding BSL4 Operations.

- **NIAID NBL/RBL Facilities Network.** As part of the ongoing collaboration with other institutions who are home to biocontainment research facilities, Mr. Grimaldo actively participates on the conference calls for the Facility Operations Group of the **NIH/NIAID National Biocontainment Laboratory/Regional**



Biocontainment Laboratory Network. He also coordinated training activities for visiting biocontainment facility engineers and maintenance staff from the NBL/RBL Network during the annual meeting of the group in April 2013 (*pictured top*). The GNL was pleased to host this 5th Annual Meeting in April 2013. This was the third time that UTMB has hosted this meeting. Biocontainment researchers and practitioners (*pictured bottom*) from the 15



academically-based BSL3 and BSL4 laboratories supported by NIAID travelled to UTMB for two days of collaborative meetings. The topic of biosecurity always plays a prominent role in this meeting and the staff of the National Biocontainment Training Center, like Mr. Grimaldo, played a key role in biosafety instruction and presentations.

- **Guests and Outside Groups/Visitors.**
 - *August 2012 quarterly report* - the NBTC was honored to be among the UTMB infectious disease groups to host summer interns from West Point. West Point cadets Nicholas Tubbs and Whitney Strong spent part of their summers as interns through UTMB's Institute for Human Infections and Immunity while participating in the Academy's Academic Individual Advanced Development program. The purpose of the AIAD program is to provide a venue for educational experiences that would not be possible within the usual framework of academic, military, and physical programs. Cadet Tubbs completed a biocontainment engineering internship with the NBTC's Miguel Grimaldo in the GNL and Cadet Strong joined the lab of Dr. Alex Freiberg in Keiller for a scientific research internship. Cadet Tubbs shadowed GNL biomechanical engineers during his stay, learning the basics of building engineering from air flow and filtration to electronic monitoring systems and routine maintenance. Cadet Strong was involved in two research projects to learn about different laboratory techniques. She worked on the characterizations of Rift Valley fever virus glycoprotein mutants and of recombinant expressed Nipah virus proteins. These types of internships provide an excellent "on the job" training opportunity to students with an interest in biocontainment research and engineering.
 - *August 2012 quarterly report* - One of our newest biocontainment trainee/researchers who has an active interest in biosecurity and biocontainment has decided to pursue a nontraditional path outside of the bench research arena. Dr. Ashley Grant has been selected as a fellow in the 2012 class of the *Emerging Leaders in Biosecurity Initiative* by the Center for Biosecurity at the University of Pittsburgh. Over 150 talented individuals from across the country applied for the prestigious fellowship and Dr. Grant was among the 25 awardees. Fellows participate in a series of events in Washington, D.C., designed to facilitate candid discussions about current and anticipated biosecurity challenges and to afford them the opportunity to contribute ideas to the U.S. scientific and policy communities. Dr. Grant's participation in the program places her in elite company alongside participants from federal agencies, national laboratories and academia. Dr. Grant has also been awarded the National Academies Christine Mirzayan Science and Technology Policy Graduate Fellowship Program sponsored by the National Academy of Sciences and its constituent organizations (collectively known as the National Academies). She will be a policy fellow with the Committee on International Security and Arms Control (CISAC) within the Policy and Global Affairs (PGA) Division focusing on the India-U.S. Workshop on Biosafety and Biosecurity and development activities associated with CISAC's Chinese and Russian biosecurity dialogues. *As an update to this entry, another member of the GNL team was selected to participate in the second class (2013) of the Emerging Leaders in Biosecurity Initiative by the Center for Biosecurity at the University of Pittsburgh. Michael Patterson, a virology student soon due to complete his course of study at UTMB, will participate in the program beginning later this fall. We will make note of his progress in future quarterly reports.*

- *Current reporting quarter* - A pilot course entitled *Achieving Data Quality and Integrity in Maximum Containment Laboratories* was held April 1-5, 2013 in the GNL. Developed as a collaborative project between UTMB and the United States Food and Drug Administration (FDA), the training program included four days of instruction plus a half day of interactive mock-BSL4 laboratory exercises in the NBTC training laboratory (*pictured is NIAID program officer Dr. Kimberly L. Taylor in a BSL4 training suit in the mock training laboratory*). The primary course objective was to cross educate sponsors, scientists, veterinarians, quality assurance personnel, regulators, Agency reviewers, and Agency policy-makers to enable



the conduct of regulated studies in support of product approval via FDA's Animal Rule. For many Agency reviewers and Sponsor Contracting Officers, the laboratory exercise was a rare opportunity to experience physical restrictions due to biosafety requirements. Sixty-nine attendees participated in the course, including FDA representatives from the Centers for Drugs, Biologics, and Veterinary Medicine, the Office of Regulatory Affairs, and the Office of Counterterrorism and Emerging Threats. Faculty and attendees included members from the Centers for Disease Control and Prevention (CDC), Department of Army Inspector General (DAIG), Battelle, US Army Medical Research Institute of Infectious Diseases (USAMRIID), National Institute of Allergy and Infectious Diseases (NIAID), National Biodefense Analysis and Countermeasures Center and the Health Protection Agency (HPA) from Public Health England, United Kingdom.

Additional training opportunities of note over the past reporting year.

- *October 2012 quarterly report* – On October 1, 2012 Belinda Rivera and Dr. Curtis Klages travelled to Baylor College of Medicine Houston to provide hands-on ferret training to four individuals involved in influenza research. Training was requested by and provided to a principal investigator and his research staff in anticipation of the start of an influenza study utilizing ferrets. They specifically asked the NBTC staff to provide training for them on ferret handling techniques in BSL2 biocontainment.
- *October 2012 quarterly report* – NBTC trainers and staffers Vickie Jones, Belinda Rivera, Je T'Aime Newton, Dee Zimmerman, Miguel Grimaldo and Sophie Brocard attended the 54th American Biological Safety Association (ABSA) annual meeting October 18-24, 2012 in Orlando, Florida to promote the training program, maintain continuing education credits and augment nation and international networking groups. The ABSA conference is the nationally and internationally recognized biological safety conference for biosafety professionals. The conference is the focal point for current biosafety professional development, accreditation, national and international recognition and resources. Pre-conference courses are designed to provide training for

those entering the field as well as allowing for maintenance accreditation for the Registered Biosafety Professional and the Certified Biosafety Professionals.

- Ms. Rivera taught a pre-conference course at ABSA entitled *“Introduction to a Nonhuman Primate Training Program.”*
 - Ms. Zimmerman co-taught a pre-conference course entitled *“BSL3 Operation and Maintenance”* at the conference.
 - Dr. Brocard co-taught a pre-conference course entitled *“Introduction to Biological Risk Assessment”* at the conference.
 - Ms. Jones facilitated the pre-conference courses *“Concepts of Virology and Virus-based Gene Vectors”* and *“Fundamentals of Biosafety”*.
 - Ms. Zimmerman facilitated the pre-conference courses *“Biosafety Management Techniques for Improving Organization Program Understanding and Support.”*
 - Ms. Newton facilitated the pre-conference course *“Fundamentals of the Class III Biosafety Cabinet.”* This course was held at the Germfree company facilities in Ormond Beach, Florida. As the Chair of the Pre-Conference Course Committee Ms. Newton was responsible for all the pre-course meetings with the facilitators and ensuring that all the courses at the pre-conference had the needed material and ran smoothly. A total of 27 courses over a 3 day period were offered this year.
 - Dr. Brocard facilitated the pre-conference course *“Aerobiology in Infectious Disease Research: Fundamental and Applied Concepts.”*
 - Mr. Grimaldo participated in the daylong session *“Sharing Biorisk Management Success Stories.”* As a part of this session, he provided information regarding the training program to many potential international training fellows.
- *January 2013 quarterly report* - During this reporting quarter, senior biocontainment veterinarian Dr. Curtis Klages traveled to the Oregon Health & Science University and the Oregon National Primate Research Center to discuss and evaluate the operation of their ABSL3 non-human primate facility. This trip also determined the scope of training that the NBTC could potentially offer the university/center in the operation of their ABSL3 laboratories. Follow-up discussions and a training proposal will be provided to the group during the next reporting quarter.
 - *Current reporting quarter* – In April 2013, and NBTC trainer was invited to The University of Texas at Austin to provide BSL3 theoretical and practical training for 15 staff (10 participated in the theoretical course only and 5 took the full course – *four of whom are pictured*) who will work in the containment laboratory. The principal investigator, biosafety officer, safety manager, graduate student researchers, and staff were trained in biological safety techniques critical for functional operation in a BSL3 environment. The



participants were very engaged throughout the training often asking questions and posing scenarios. Evidence of achievement by the trainees was demonstrated in successful completion of theoretical and practical assessments. All participants were awarded certificates.

Table 1. Summary of training courses offered and number of participants in each course, May 2009 through April 2013.

Training Course/Module	May-Dec 2009	Jan-Dec 2010	Jan-Dec 2011	Jan-Dec 2012	Jan-April 2013	Total
BSL4	9	28	59	47	12	155
BSL3 Theoretical	45	119	100	135	34	433
BSL3 hands-on	45	101	94	76	29	345
BSL2 Theoretical	107	144	251	160	24	686
BSL2 hands-on	64	76	92	117	16	365
ABSL3 Theoretical	29	55	47	73	17	221
ABSL3 hands-on	29	50	46	37	19	181
ABSL2 Theoretical	N/A	1	79	149	94	323
ABSL2 hands-on	N/A	1	40	76	81	198
Graduate Program	39	36	32	13	0	120
Aerobiology	19	5	2	8	0	34
Autoclave	195	27	46	30	9	307
High Throughput Safety training	8	11	3	2	2	26
Non-human primate theoretical	16	15	60	41	4	136
Non-human primate hands-on	N/A	N/A	90	41	8	139
Non-human primate annual refresher	N/A	N/A	37	114	0	151
BSL3 mentorship	36	41	24	18	4	123
ABSL3 mentorship	N/A	N/A	38	19	9	66
PAPR	N/A	10	49	52	31	142
Intro to Micro	18	0	6	4	0	28
Animal handling certificates	N/A	N/A	22	75	3	100
ABSA/AfBSA courses	84	175	87	207	40	593
Total trained	743	895	1304	1494	436	4872

Figure 3. Total number of courses administered annually over the history of the biosafety training program – May 2005-December 2012. The creation of the NBTC in 2009 has contributed significantly to the exponential growth of the biosafety training program.

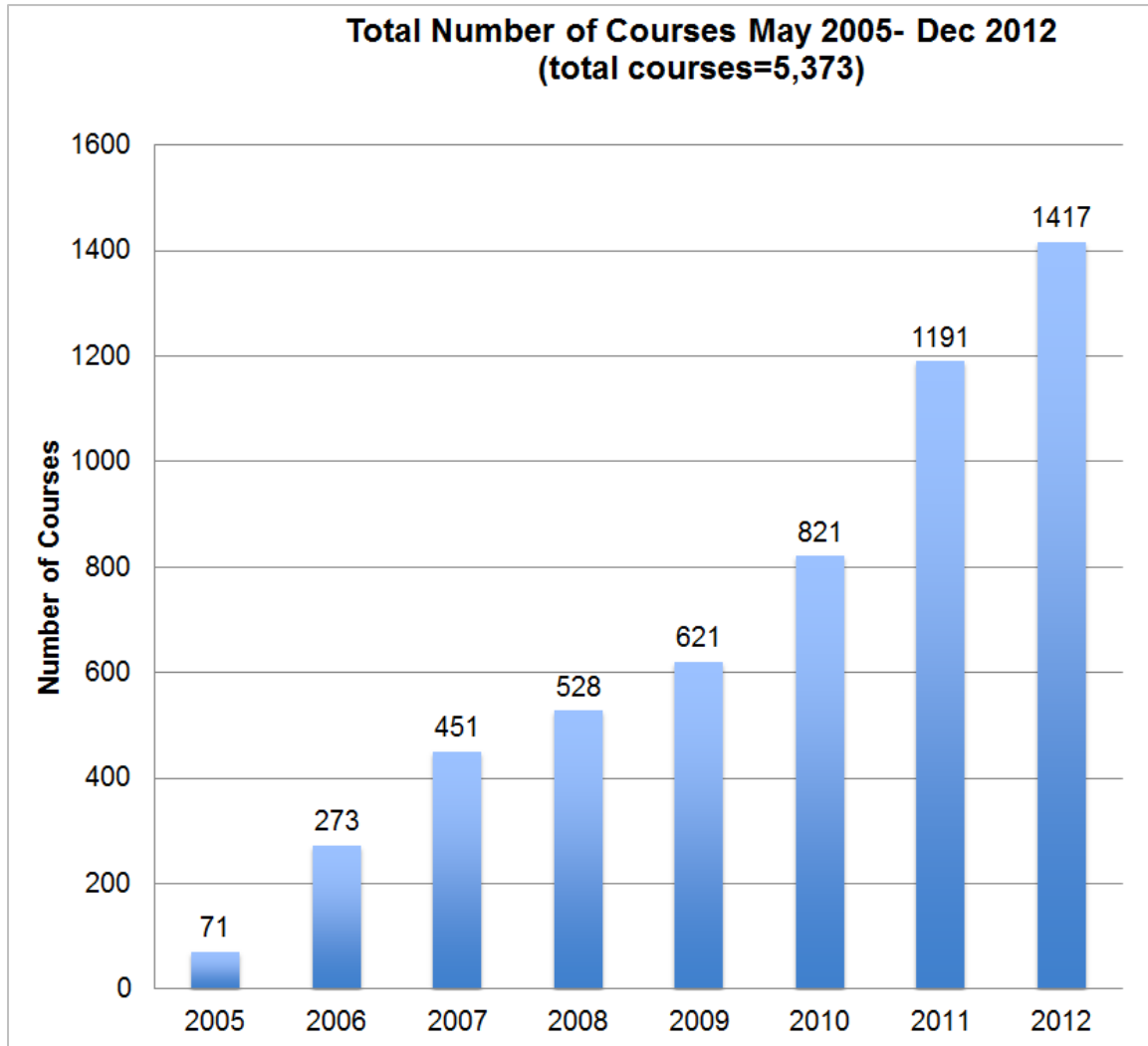
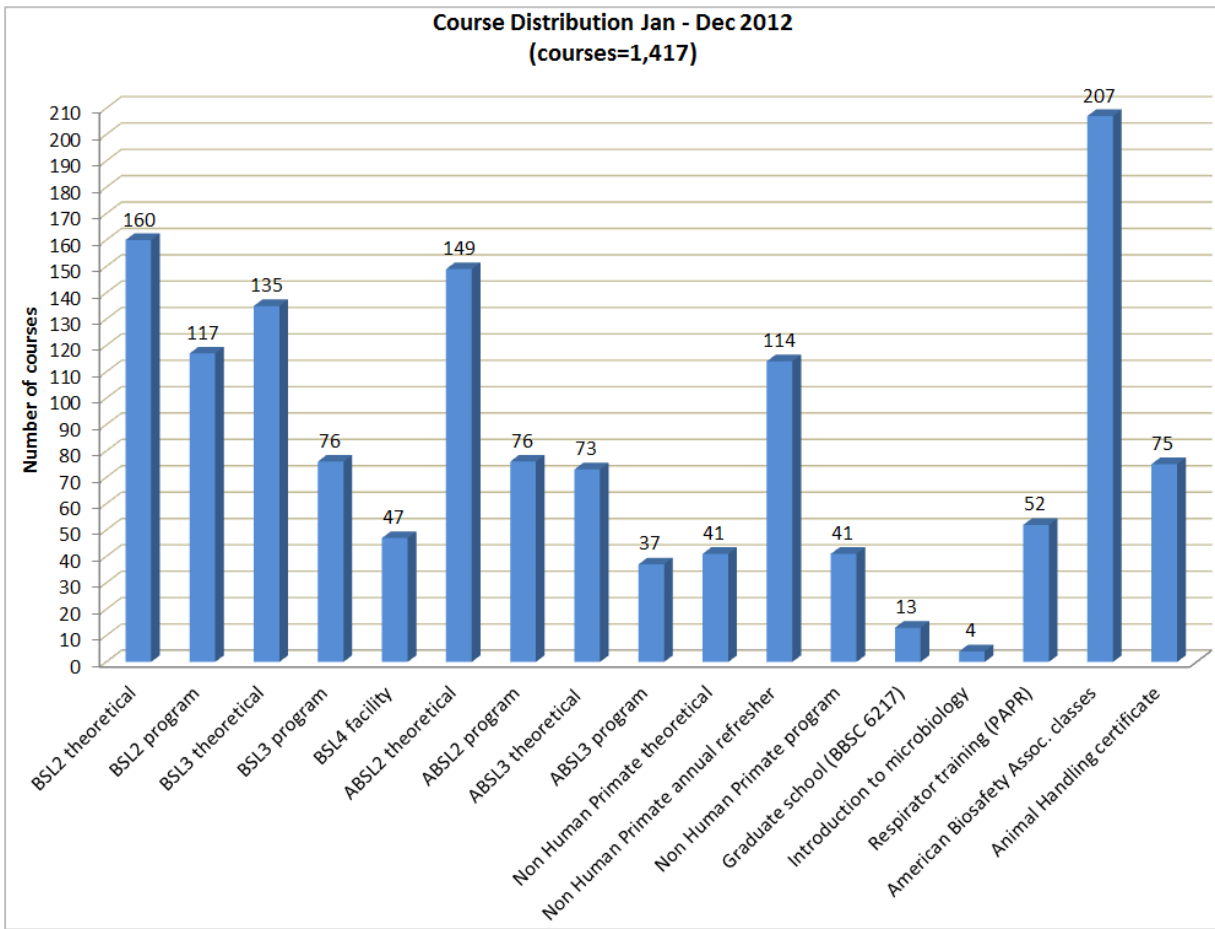


Figure 4. Distribution of courses administered during the 2012 calendar year. This chart provides a glimpse into the demand for courses over a twelve month period.



KEY RESEARCH ACCOMPLISHMENTS 2012-2013:

- A comprehensive, standards-based training program has been established and implemented to prepare individuals for work at all levels of biocontainment.
- Advanced, mentored training is available to select fellows with exceptional skill who desire to expand their research activities to include studies at the BSL4 level.
- A unique fellowship has been created to train the next generation of containment laboratory facility operations professionals prepared to oversee the safe operations of these complex facilities.
- A novel training opportunity addresses the safety considerations emerging at the interface of high through-put screening of potentially infectious material.
- As part of our participation in the national dialogue on biosecurity – and as a service to the research community – we also established the *Topics in Biosecurity Symposia Series*. Sessions offered thus far continue to be attended by large crowds and draw positive attention and feedback. Planning is underway to continue the series with 2013-2014 sessions.

REPORTABLE OUTCOMES 2012-2013:

- Since the inception of UTMB's Laboratory Biosafety Training Program, prior to the TATRC funding award in 2009, nearly 5,000 individuals – both internal to UTMB and external, both nationally and internationally – have been instructed in the safe research and operation in biocontainment laboratories. The vast majority of these trainees have taken part in the program since 2009 when TATRC funding allowed for significant growth of the program.
- Requests for external biosafety training are being continuously received. As evidenced by the list below, this past reporting year has been an active one. Several events have already been scheduled for the next reporting year.

2012 External Training at UTMB:	
January	BSL3 - one individual from University of Monterrey in Monterrey, Mexico
March	BSL3 - two individuals from City of Houston Department of Health & Human Services ABSL3 - one individual from UT-San Antonio ABSL3 - one individual from Baylor University in Waco, TX
July	BSL2 - one individual from University of Houston in Houston, TX BSL3 - two individuals from City of Houston Department of Health & Human Services
August	BSL2 - one individual from UT-Austin BSL3 - one individual from KOC University in Istanbul, Turkey BSL3 - three individuals from UT Southwestern ABSL3 - one individual from KOC University in Istanbul, Turkey
September	BSL2 - two individuals from Lynntech, Inc. in College Station, TX BSL3 - two individuals from City of Houston Department of Health & Human Services

November	BSL2 - one individual from Lynntech, Inc. in College Station, TX BSL2 - one individual from Milwaukee School of Engineering in Milwaukee, WI BSL3 - one individual from Milwaukee School of Engineering in Milwaukee, WI BSL3 - one individual from City of Houston Department of Health & Human Services
2013 External Training at UTMB:	
January	BSL2 - one individual from Texas Southern University (TSU) in Houston, TX BSL3 - one individual from the Brooke Army Medical Center in San Antonio, TX
February	ABSL3 - one individual from Arizona State University in Tempe, Arizona
March	BSL2 - one individual from ABC Actini in Lewis Run, PA ABSL3 - two individuals from UT El Paso
April	BSL3 - two individuals from University of New Mexico in Albuquerque, NM ABSL3 - one individual from University of Houston ABSL3 - one individual from Research Animal Resource Center in New York, NY
May	BSL2 - two individuals from University of Houston BSL3 - one individual from Oklahoma State in Stillwater, OK BSL3 - one individual from Fred Hutchinson Cancer Research Center in Seattle, WA
July – (confirmed)	BSL2 - one individual from NuAire in Phoenix, AZ BSL3 - one individual from Booz Allen Hamilton, Inc. (DTRA contractor) in Lorton, VA BSL3 - one individual from Arizona State University in Tempe, AZ
August	BSL3 - one individual from University of New Mexico in Albuquerque, NM
December	BSL3 - one individual from Texas A&M University in College Station, TX
Offsite Training 2012-2013	
January 2012	BSL3 - four individuals at Battelle Facility in Columbus, OH ABSL3 - four individuals at Battelle Facility in Columbus, OH
May	BSL2 & BSL3 in Pergamino, Argentina (35 trained)
June	BSL3 - six individuals at City of Laredo Health Department in Laredo, TX
August	BSL3 - 44 individuals at AFRIMS Facility in Bangkok, Thailand ABSL3 - 14 individuals at AFRIMS Facility in Bangkok, Thailand NHP - 22 individuals at AFRIMS Facility in Bangkok, Thailand BSL2 - 11 individuals at Caliber Biotherapeutics in College Station, TX BSL3 - 23 individuals at CENETROP facility in Santa Cruz, Bolivia
April 2013	BSL3 - 16 individuals at UT Austin facility in Austin, TX
Pending for 2013	
	BSL2 - 6 individuals training at UTMB from Methodist Hospital in Houston, TX
	BSL3 - 6 individuals at the Florida Department of Agriculture in Kissimmee, FL
	BSL3 - 6 individuals either at UTMB or at Tulane University in New Orleans, LA

CONCLUSIONS:

The National Biocontainment Training Center offers a robust and intensive training program devoted to all aspects of biological safety, biocontainment, and biosecurity. This program offers unique, hands-on training to trainees, staff and external partners at all levels of biocontainment, including focused, mentored training in the BSL4 laboratory.

Nearly 5,000 persons have benefited from one or more of these training courses, many of whom are now pursuing graduate education and using these specialized skills in the recently constructed GNL containment facilities. Intensive, mentored fellowship programs have been established to offer opportunities for in-depth training in research under BSL4 conditions and also in containment laboratory operations and maintenance. These fellowships are proving quite successful and are helping address the critical national shortage of well-trained containment laboratory scientists and facility operations specialists.

REFERENCES:

None.